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A HYPERTEXT VERSION OF THE CERTIFIED PROFESSIONAL CONTRACTS MANAGER CANDIDATE'S WORKBOOK

THESIS

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AFIT/GCM/LSP/91S-8

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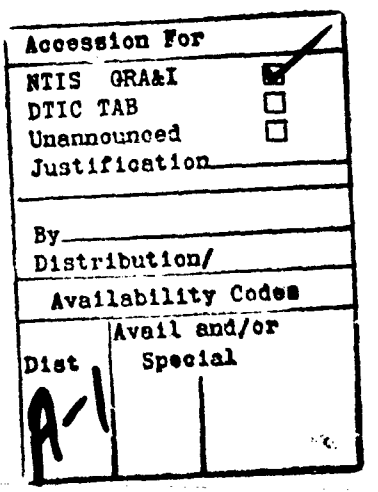

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A HYPERTEXT VERSION OF THE CERTIFIED PROFESSIONAL CONTRACTS MANAGER CANDIDATE'S WORKBOOK

THESIS PROPOSAL

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Contracting Management

Dean P. McLain, B.S.
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Abstract

The purpose of this study was to develop and test a hypertext version of the Certified Professional Contracts Manager Candidate's Workbook and Supplements.

A literature review was conducted on two distinct subject areas. The first area includes a review of the findings of six commissions on professionalism of acquisition personnel, initiatives of the Office of Personnel Management (OPM), the Defense Acquisition Workforce Improvement Act, and the National Contract Management Association. The discussion of professionalism in contracting establishes the relevance of products like the hypertext workbook completed as a result of this research. The second area is a review of the history of hypertext, applicable definitions, application schemes, and system design.

Through a development effort that followed five objectives, a complete hypertext workbook was designed and tested. The results of the questionnaire answered by ten graduate students revealed that the hypertext workbook was easy to install, learn and use.

A HYPERTEXT VERSION OF THE CERTIFIED PROFESSIONAL CONTRACTS MANAGER CANDIDATE'S WORKBOOK

I. Introduction

This section introduces the research. First, the growing importance of continued education within federal contracting is discussed. Second, a brief discussion of the National Contract Management Association (NCMA) is presented. NCMA's certification programs are explained, in addition to the Certified Professional Contracts Manager Candidate's Workbook. Third, the disadvantages associated with the linear version of the workbook are described. Fourth is a concise description of hypertext as it will be used for the development of a computerized CPCM Candidate's Workbook. Fifth, the objectives that structure this research are presented. Sixth, the scope and limitations of this research are identified. The organization of this thesis is outlined last.

The Contracting Work Force

The contracting work force is professionalizing. Since 1950, six major commissions have made recommendations related to heightened professionalism in the procurement arena. More recently, the Defense Acquisition Workforce Improvement Act (DAWIA), H.R. 4739, carried out the recommendations of earlier commissions.

DAWIA was attached to the Department of Defense Authorization Act for Fiscal Year 1991. It focuses on the education, training, and

career development of both the military and civilian components of the federal contracting work force. Included in the legislation are plans to form an Acquisition Corps. DoD Directive 5000.52 defines the Acquisition Corps as:

> A narrowly defined part of a Service's acquisition workforce, composed of selected military and civilian acquisition personnel who dedicate their careers as acquisition specialists. (8:v)

Several criteria must be met in order for an individual to be recognized as a member of this elite group of professionals. Among the prerequisites are educational standards. The future of professional continuing education for this group is therefore growing in importance.

In order to keep pace with these increased standards and challenges, individuals can attend one of the over 100 colleges and universities that offer undergraduate and postgraduate contract management programs and courses (30:23). In addition, professional organizations exist that can assist in meeting these needs.

The National Contract Management Association

The National Contract Management Association (NCMA) is the foremost professional organization in the contracting career field. According to the 1990 National President, James B. Lessig, "Education is our primary mission and the most important way we serve our members" (22:2). Record numbers are seeking professional certification through the two nationally recognized certification programs offered by NCMA. The two programs are the Certified Professional Contracts Manager (CPCM), and the Certified Associate Contracts Manager (CACM). Although both programs are notable, the CPCM is the more prestigious. The "CM

Final Edition" in the January 1991 issue of Contract Management recorded that "The number of individuals sitting for the November 9, 1990, certification exams - 201 CPCM, 19 CACM - surpassed last November's record of 173 and 15, respectively" (6:34).

NCMA educational goals are structured to meet the growing needs of the procurement work force. The long-range goals for its education program are:

> (1) Preparation of educational materials in contract management based on high standards of scholarship and research, and (2) preparation of monographs, reference materials, or manuals that have value not only in university programs, but as trade publications useful to contract management practitioners. (26:57)

NCMA's annual National Education Seminar has evolved into a well recognized avenue for organizations to supplement their training needs. In addition, NCMA offers a wide variety of educational products in eight categories: 1) Topical Issues in Procurement Series (TIPS); 2) Reference/Study Materials; 3) Workshops; 4) Computer Diskettes; 5) Books; 6) National Education Seminar Manuals; 7) Challenge Monograph Series; and 8) Videotapes (22:60).

Reference/Study Materials

Included in the Reference/Study Materials are the CPCM Candidate's Workbook, the CPCM Workbook, Supplement 1, Supplement 2, and Supplement 3, (hereafter referred to as the Workbook, and Supplements). The four publications were compiled and edited by Frederic M. Denny, MBA, CPCM. The purpose of the texts is to help CPCM candidates organize an approach to the CPCM examinations, and to

provide the contents of past examinations used for preparing of future tests (7:xv).

The materials are well planned and structured. They unquestionably provide the services that were intended. The publications' usefulness is highlighted by an appendix that provides an analysis of past exams. The appendix consists of six different summaries that allow the CPCM candidate to review the makeup of past exams. For example, the second summary gives a sequential listing of all of the questions from all of the exams. It groups the questions by the category in which it first appeared, and includes the total number of appearances (7:xv). The value of the text notwithstanding, the Workbook does have certain disadvantages.

Disadvantages of the Workbook. The disadvantages of the documents are related to their growing size. The Workbook and Supplements currently comprise over 800 pages. In consideration of publishing and postage costs alone, it is easy to see why the three materials cost $55 for NCMA members. Candidates must flip pages and cross-reference question numbers to page numbers in the search for a question of interest. Since the Workbook alone consists of approximately 500 pages filed in a three-ring binder, it can be cumbersome to use. While NCMA offers a few of their products in the form of computer diskettes, nobody has explored the feasibility of an electronic form of the Workbook.

Advances in software technology have made an electronic form of the Workbook possible. The Executive Director of the National Contract Management Association believes that an "interactive computerized study

tool based on NCMA's CPCM Candidate's Workbook and its supplements would be a major contribution to NCMA's Educational Product offerings" (14).

Hypertext is one approach that is bringing publications into the information age. It is a feature of fairly new software programs that makes possible the ability to link information electronically. One software manufacturer described hypertext in the following manner:

> In a hypertext document, rather than turning pages to find more information or using an index to find a topic, it is structured so that wherever more information exists it is linked off a key word or phrase. (29:1)

Advantages of Hypertext Documents. A hypertext document can potentially overcome the disadvantages associated with bulky publications. Hypertext gives readers no preconceptions regarding the size of a document (28:23). The sheer physical size of the Workbook and Supplements might possibly intimidate CPCM candidates, or even scare them from taking the examination. "Highly organized or centralized hypertext documents with a very rigid structure tend to seem smaller than their actual length" (28:23). Upon entering a hypertext document, users can choose from a number of desired paths toward an area of interest. The process of browsing information is systematic and focused, while the length of the document is less obvious (28:23). Hypertext systems eliminate the flipping of pages; cross-referencing takes less than a second. A hypertext workbook could also be supplemented periodically. Additionally, the costs associated with mailing diskettes would be substantially less than heavy paper editions.

Specific Problem

The purpose of the research was to develop and test a hypertext version of the CPCM Candidate's Workbook and Supplements. The Workbook is functional; however, the stated potential benefits of a hypertext version exist, and would facilitate the learning process.

Research Objectives

Five objectives structured the research effort.

Objective 1. The first objective was to obtain permission to create a hypertext version of the National Contract Management Association's CPCM Candidate's Workbook and Supplements.

Objective 2. The second objective was to identify the important features of hypertext authoring systems needed for the research.

Objective 3. The third objective was to develop the hypertext model. Three sub-objectives structured this step even further.

Sub-Objective 3a. The first sub-objective was to design the hypertext model's structure on paper.

Sub-Objective 3b. The second sub-objective was to convert the text of the Workbook and Supplements into machine readable format.

Sub-Objective 3c. The third sub-objective was to determine a method with which to present the information within the hypertext system.

Objective 4. The fourth objective was to test and evaluate the hypertext system.

Objective 5. The fifth objective was to implement improvements to the hypertext system that were identified during the testing stage.

Scope and Limitations

Software development requires several iterations of the above objectives to refine a system to its fullest potential. This research involved only one iteration.

Potential users of the hypertext system include a vast population of civilian and military contracting personnel across the country. A comprehensive review of the customers' needs was beyond the scope of the research. An initial model was developed to test the feasibility of a hypertext version of the Workbook, and to receive initial feedback of the model. To facilitate the process, an Air Force Institute of Technology faculty member and fellow graduate student acted as the users. Both are CPCM's, and the faculty member is an honorary life member of the National Contract Management Association.

Thesis Outline

Chapter 1 introduces the research by presenting a background of the specific problem and identifying the research objectives.

Chapter 2 expands on the relevant topics of the research, development of professionalism in contracting from an historical perspective, and hypertext systems.

Chapter 3 is a discussion of the methodology that was used to develop and test the hypertext document.

Chapter 4 reports the results.

Chapter 5 completes the research with conclusions and recommendations.

II. Literature Review

Introduction

This chapter includes discussions of two dissimilar subject areas. They are professionalism in contracting from a historical perspective and issues regarding hypertext.

The first major discussion begins with the findings and recommendations of six major commissions on professionalism in contracting. Initiatives since the Defense Management Review of 1989 are then examined, followed by a short discussion of education in contracting. Next is a description of the National Contract Management Association (NCMA), its membership, mission, certification programs, body of knowledge, and endeavors to improve the body of knowledge.

The second major topic includes issues regarding hypertext. First, the history and definition of hypertext will be given. Other key terms associated with the topic will be defined. Hypertext application schemes will be discussed third. Fourth, the steps required to develop a hypertext system will be explained. Finally, this chapter closes with important issues and caveats regarding the design of hypertext programs.

Professionalism in Contracting

The United States Government's role as a leading defender of democracy has been a costly endeavor. In Fiscal Year 1988 alone, the Department of Defense (DoD) contracted for over $161.7 billion in services, supplies, and military hardware (37:330). Thus, it is not surprising that the acquisition of major weapon systems and the

competition of these efforts with non-defense programs have long been subjects of public scrutiny. In fact, apprehension regarding the use of public funds for the procurement of military supplies and equipment dates back to the French and Indian Wars when the price and quality of goods were issues of controversy (39:2).

Since 1950, seven major commissions have been established by either the President or Congress to review U.S. defense acquisition organization and procedures. The recommendations provided by these reports address a number of similar issues (39:4). Improving the quality of the acquisition work force is a theme of six of these commissions, and will be discussed further.

Six Major Commissions

The following discussion is limited to the findings and recommendations of six commissions on professionalism of acquisition personnel. The word acquisition is used in the broad sense, and includes functions such as: program management; systems planning, research, development, and testing; contracting; engineering; manufacturing and production; property management; logistics; quality control and assurance; and several others. The commissions include: 1) two Hoover Commissions (1949 and 1955); 2) the Fitzhugh Commission (1970); 3) the Grace Commission (1983); 4) the Packard Commission (1986); and 5) the Defense Management Review (1989).

First Hoover Commission (1949). The First Hoover Commission was performed shortly after the National Security Act of 1947, and thus concentrated on broad organizational issues. However, traces of interest regarding defense procurement can be found in the task force

working paper on national security organization. It addressed the need for increased competency and frugality. The following comment from the executive summary typifies the sustained public concern over procurement:

> Nowhere is cost-consciousness more essential than in the military establishment - that vast and complex organization which currently absorbs more than 30 percent of the annual national budget. (39:6)

Second Hoover Commission (1955). The Second Hoover Commission specifically addressed the failure of Secretary of Defense Directive 4000.8. This directive was issued in 1952 to enrich the competence of procurement personnel (39:9). The following recommendations were made at the conclusion of this commission to rectify the lack of action:

> 1) Strengthen career opportunities. 2) Establish definite criteria for staffing. 3) Increase pay in the upper grades. 4) Confine rotation of military managers to specialized support areas; and 5) Assign officers to management positions for longer periods. (39:9)

Fitzhugh Commission (1970). Fifteen years after the Second Hoover Commission, the Fitzhugh Commission was appointed to address concerns regarding cost overruns and the organization and management of the Department of Defense. Special attention was given to DoD's procurement policies and practices. The following paragraph addressed the state of the DoD procurement work force:

> Regardless of how effective the overall system of Department procurement regulations may be judged to be, the key determinants of the ultimate effectiveness and efficiency of the Defense Procurement process are the procurement personnel who have the challenging responsibility for interpreting and applying the regulations and associated guidance material. The importance of this truism has not been appropriately reflected in the recruitment, career development, training, and management of the procurement work force. As a consequence, the Department is faced with a significant

> number of immediate and future problems with respect to the availability in adequate numbers of appropriately qualified and capable procurement personnel. For example, major problems exist with respect to their aging, turnover, capabilities, and utilization. (39:241)

Grace Commission (1983). The Grace Commission was an executive committee established by President Reagan in 1982. The charter of the council was to identify improvement areas that could reduce cost. The following is a pertinent statement found in the executive summary of the report:

> As would be expected in a democracy, DoD is under constant scrutiny by Congress, the Office of Management and Budget (OMB), the White House, the media, special interest groups for and against its activities, its employees, its retired employees, business leaders, and the general public. (39:603).

In order to stand up to the scrutiny, the Grace Commission recommended the development of professional procurement personnel (39:VI).

Packard Commission (1986). David Packard chaired President Reagan's Blue Ribbon Commission on Defense Management. The Packard Commission reported on the quality of defense acquisition issues. Several recommendations in this report were specifically designed to enhance the quality of the acquisition work force. The opening remark of the section titled, "Enhance the Quality of Acquisition Personnel", begins with "DoD must be able to attract and retain the caliber of people necessary for a quality acquisition program" (39:947). Further remarks included,

> Federal regulations should establish business-related education and experience criteria for civilian contracting personnel, which will provide a basis for the professionalization of their career paths. Federal law should permit expanded opportunities for the education and training of all civilian acquisition personnel. (39:948)

Defense Management Review (1989). Despite the interest of past commissions toward the acquisition work force, little ground was made toward increased professionalism in procurement during the three years after the Packard Commission (9:13). Secretary Cheney's Defense Management Report to the President is a plan that focuses on the implementation of the Packard Commission's recommendations. The report specifically identified several steps needed to increase the professionalism of the procurement work force. The classification of DoD contracting officers as a professional personnel series was one recommendation made for civilians, while plans for the establishment of an acquisition corps of officers in each Service were discussed for the military (9:13-14).

OPM Initiatives

Six months after the completion of the last report, the Director of the OPM signed a letter to the Deputy Secretary of Defense that changed the classification of the GS-1102, Contracting series from administrative to professional. The letter stated

> I have decided that contracting positions will be designated as professional. That designation recognizes the development of the contracting occupation into one which requires a high level of competence in several disciplines. In addition, OPM will issue soon a new qualification standard for contracting positions. (27:1)

Specific examples of occupations within the GS-1102 series are contracting officers, administrators, negotiators, termination specialists, and cost/price analysts. It is difficult at this point to report the exact impact of this change on the work force; however, the

change provides recognition that certain skills are essential to perform in the stated occupations.

The Office of Federal Procurement Policy (OFPP, a part of OMB) is required by statute to promote Government-wide career management programs for a professional procurement work force (3:1). To support the move toward professionalism in the career field, the office has teamed up with several agencies to develop a detailed Procurement Professionalism Plan. The tasking, named the OFPP Professionalism Group, includes members from selected Executive agencies, the Federal Acquisition Institute (FAI), the Office of Personnel Management and the Merit Systems Protection Board (3:1). Monthly meetings have been held since July, 1990 in order to develop the Procurement Professionalism Plan. The plan is to include the following:

> a. A coordinated approach for the recruitment of procurement interns by Federal agencies based on forecasted requirements;
> b. A program for the training of procurement personnel in those competencies identified as necessary for professional-level performance, after coordination with Procurement Executives. This training program will ensure the efficient and effective use of procurement education and training facilities, and promote on-the-job training and other methods to inculcate necessary competencies in the most cost-effective manner;
> c. Proposals for retaining qualified professionals; and
> d. Goals for and measures of success in meeting the objective of a better qualified procurement work force, as well as a system for continually evaluating the efficacy of the procurement professional program. (4:2)

Included in the minutes of the Group's meetings are discussions regarding FAI Blueprints which may eventually become the standard for acknowledgement of a competent GS-1102 (40:2).

Defense Acquisition Workforce Improvement Act

On November 6, 1990, the Department of Defense Authorization Act for Fiscal Year 1991 was signed by President Bush. Attached as an amendment was the Mavroules bill, now called the Defense Acquisition Workforce Improvement Act (DAWIA). The DAWAI requires the implementation of meaningful provisions in the acquisition arena. Some of the changes include the identification of critical acquisition positions for the establishment of an Acquisition Corps, and the formulation of a diverse arrangement of educational and training opportunities for acquisition personnel (2:1). New educational and experience standards are required for entry into the Acquisition Corps, which will be phased into effect over a three year period.

At the direction of the Under Secretary of Defense for Acquisition (Honorable John A. Betti), a DAWIA Implementation Board was formed in November 1990 to advise on the execution of the law. The charter of the Board states

> The Board will oversee the implementation of these requirements including: policies for defining, accessing, educating, training, managing and providing for career development of the defense acquisition workforce; the identification of critical acquisition positions and policies for increasing the proportion of civilians in these positions; implementation of Acquisition Corps in the Services, OSD and the Defense Agencies; policies for rotation requirements, mobility statements, examinations, waivers and a centralized job referral system; and requirements for a variety of education and training programs including a scholarship program and the development of a structure for a defense acquisition university. (2:2)

Analysis of the Initiatives

The new professional classification of the GS-1102, Contracting series, did not by itself instantaneously solve the previously identified problems in the career field. However, the Defense Acquisition Workforce Improvement Act did identify qualification standards for the future. According to Section 1724 of the DAWIA, no person may be employed by the Department of Defense after 1 October 1993 in the GS-1102 occupational series, or be appointed as a contracting officer (for other than small purchases), unless the person has:

> (1) received a baccalaureate degree; or (2) completed 24 semester hour of college study in business, finance, quantitative methods, or management-related subjects; or (3) passed an examination considered by the Secretary of Defense to demonstrate skills, knowledge, and at least 24 semester credit hours in business, finance, quantitative methods or management-related subjects. (38:§1724)

The legislation does provide for certain exemptions and waivers to the academic requirements established above. However, in light of the failure of past commission recommendations, the initiatives made over the last year reflect profound change. Professionalism in the contracting career field is quickly becoming a reality rather than a recommendation. Training, education, and experience will be the basis for entry into the GS-1102, Contracting Series and the Acquisition Corps.

Education

Based on the above discussion of literature, it can reasonably be concluded that specialized education in contracting disciplines will be of growing concern among contracting individuals. In his thesis, The

Identification of Contracting Terms in Support of the Body of Knowledge, Air Force Captain William Hauf discussed the tendency of the contracting community to focus on post-employment training and education programs (17:19). As stated by OFPP, and observed by Captain Hauf,

> As a professional and practical matter, nearly all direct training of Contracting personnel (both in the Government and in the private sector) is accomplished either through on-the-job experience or through commercial or semi-commercial development programs. (17:19)

In Chapter One it was stated that there are institutions that provide undergraduate and postgraduate contract management programs. The George Washington University procurement and training program has existed since 1968, while the Federal Acquisition Institute has fostered the development of collegiate offerings since 1976 (17:20-21). The Air Force Institute of Technology (AFIT) is now completing its fourth offering of a Masters of Science Degree in Contracting Management. The National Contract Management Association (NCMA) has also played an important role in fostering professional development in the contracting community. NCMA is the principal professional association in the career field.

National Contract Management Association (NCMA)

The following paragraphs are a discussion of NCMA's membership, mission, certification programs, body of knowledge, and endeavors to improve the body of knowledge.

Membership and Mission. Members of NCMA are employed in contracting and related fields both in private industry and government agencies. Simply put, the mission of NCMA is to encourage, guide, and

expand the professional development of its members. NCMA provides a broad spectrum of opportunities for individuals to pursue professional development. A few include monthly meetings that feature well known speakers, subscriptions to the monthly Contract Management magazine, and two notable certification programs. NCMA also offers a wide variety of educational and training publications and its own code of ethics (7:v).

Certified Professional Contracts Manager (CPCM). The CPCM is the more prestigious of the two professional certification programs offered by NCMA. The exam consists of two, three-hour sessions. During the first sitting, a candidate must answer five general examination questions. The second session requires five responses from questions in areas of concentration that correspond to contracting disciplines. There are a total of seven areas of concentration; however, the candidate must only answer three questions from one area of his/her choice, and one question from each of two other areas.

Body of Knowledge. NCMA made a conscious effort to relate its certification programs to a systematic Body of Knowledge (7:ix). According to the NCMA Board of Directors,

> Professional proficiency in contract management requires broad knowledge and a range of skills in the areas of:
>
> 1. Business management, particularly materials and operations management, industrial marketing, financial management, and related accounting.
> 2. The economics of materials and operations management.
> 3. Cost and price analysis and negotiation techniques.
> 4. Legal and regulatory aspects of procurement and contracting.
> 5. Managerial planning, decision making, communication, and control.
> 6. Procurement and contracting policy and procedures.

7. Management information systems, and information and data analysis. (7:x)

The Body of Knowledge is comprised of 69 separate blocks which fall under three major categories: 1) Basic Tools and Functions; 2) Contracts and Procurement; and 3) Special Considerations (Denny:ix). Dr. David V. Lamm explained the significance of the Body of Knowledge in the June, 1985 issue of Contracting Management.

> The body of knowledge serves as the foundation of our profession and focuses our efforts in education, training, certification, research, writing, and the development of professional standards. The body of knowledge is necessary for the practitioner because it identifies the functions established in other professional areas. The body of knowledge is necessary for the theoretician because it specifies a theoretical framework which guides development of the fundamentals and principles of our profession. (21:30)

Figure 1 represents NCMA's Body of Knowledge. The 69 blocks are broken down based on the three categories discussed above.

The Certified Professional Contracts Manager's Handbook, and its Supplements give interested candidates a feel for the scope of the Professional Body of Knowledge discussed above, in addition to information regarding the examination itself. The texts (and examination) are available to both members and nonmembers of NCMA. For a further discussion of the Handbook and Supplements, the reader is referred to the first chapter.

Endeavors to Improve. NCMA's committee on the Professional Body of Knowledge is responsible for maintaining the statement that defines the Body of Knowledge. According to NCMA, the statement is dynamic and subject to change in order to keep pace with the maturing and changing profession (7:x).

NCMA BODY OF KNOWLEDGE

BASIC TOOLS AND FUNCTIONS

ECONOMICS	ACCOUNTING & FINANCE	MATERIALS & OPERATIONS	COMMERCIAL LAW (UCC)
Macroeconomic Concepts	Cost Accounting Basics	Elements of Production	Elements of Contract
Microeconomic Concepts	Cost Accounting Standards	Elements of Industrial Marketing	Terms & Conditions
Industrial Organization	Elements of Business Finance	Elements of Logistics	Agency
Labor Economics	Financial Reports	Elements of Inventory Management	Warranties
	Break-Even Analysis	Surplus & Excess Property	Unconscion-ability
	Make or Buy Analysis	Materials Management	Breaches & Remedies

Figure 1. NCMA Body of Knowledge (17:16)

NCMA BODY OF KNOWLEDGE

CONTRACTS AND PLACEMENT

MANAGEMENT

Procurement Organization & Management	The Procurement Process	Statutory & Regulatory Foundations	The Contracting Officer

PRE-AWARD		POST-AWARD	
Acquisition Planning		Contract Administration	
Requirements Determination	Solicitations, Bids, Awards	Financial Management of Contracts	Changes
Contract Types	Source Selection	Quality Assurance	Terminations
General Contract Provisions	Source Development	Inspection Acceptance & Warranties	Claims, Disputes & Appeals
Standards & Specifications	Negotiation Strategies	Monitoring Contract Performance	Contract Closeout
Patent & Data Rights	Cost & Price Development	Contract Auditing	Acquisition Management Information Systems

Figure 1 (continued). NCMA Body of Knowledge (17:17)

NCMA BODY OF KNOWLEDGE

SPECIAL TOPICS AND CONSIDERATIONS

SPECIAL TOPICS		SPECIAL CONSIDERATIONS
Budgeting for Procurement	Socioeconomic Objectives	Consideration in Architect & Engineer Contracting
Systems Acquisition	Small & Minority Business Development	Considerations in Construction Contracting
Program/Project Management	Vendor's Management System Audit	Considerations in Service Contracting
Productivity	Subcontracting & Subcontract Management	Considerations in R&D Contracting
Automated Procurement	Commercial & Industrial Products	Considerations in ADP Contracting
Ethics, Conflict of Interest	Small Purchases	
Value Analysis	International Purchasing	
Safety, Reliability, & Maintainability	Government Property	

Figure 1 (continued). NCMA Body of Knowledge (17:18)

NCMA is supportive of research efforts aimed at bettering the field's body of knowledge. Over the past few years, NCMA has sponsored an effort to compile a master listing of government acquisition and contracting terms. At least four graduate students from the Naval Postgraduate School (NPS) in Monterey, California, and five graduate students from the Air Force Institute of Technology (AFIT) at Wright-Patterson Air Force Base, Ohio have focused their masters' theses toward this goal. The product of their research will be the eventual publication of a research based dictionary of terms by NCMA.

CPCM Candidate's Electronic Workbook. Over the past decade, innovations have changed the way computers store, manage, and retrieve information. According to Manion, survival skills in the use of microcomputers are now necessary to be successful in our changing society (23:25). In education, the microcomputer has become an established, well recognized mode of instruction. Rather than ask whether the computer should be considered for use in instruction, teachers are now asking how particular applications can be used to set up a curriculum (23:25). Stated again, the purpose of this research is to develop and test a hypertext version of the CPCM Candidate's Workbook and Supplements. Hypertext is a concept made possible by innovations in computers over the past decade.

Simply put, hypertext documents store information in nodes connected by links. Links are the key advantage of hypertext documents over conventional paper documents. The "linking ability" permits a researcher to quickly search for an area of interest. Once a desired section is located, it can then be read sequentially. The speed that

users of hypertext systems can browse large, voluminous documents is its chief advantage over manual, more cumbersome techniques. This researcher proposed to apply hypertext concepts in the development of an electronic workbook that can provide the same information as the text version. Hypertext applications, like a prototype hypertext medical therapeutics handbook, have already proven that study can become more than a passive activity of viewing linear sequences of straight text (11:68). The following paragraphs are a discussion of key terms, types of hypertext applications, and steps required to author a hypertext application.

Hypertext History and Definition

Detailed descriptions of the history and development of hypertext concepts are abundant in the literature. Schneiderman gave the following definition of hypertext in his book Hypertext Hands On!:

> The most common meaning of "hypertext" is a database that has active cross-references and allows the reader to "jump" to other parts of the database as desired. This makes the reading (and writing) process nonsequential. It is the requirement for active cross-references that makes a computer necessary to implement hypertext. (32:3)

Vannevar Bush, Science Advisor for President Roosevelt, is widely known for laying the groundwork for a concept known as hypertext (6:20; 31:168; 35:816). Bush's 1945 article in Atlantic Monthly discussed an innovative machine called a "memex" that includes on-line text and is designed to allow browsing (35:816). Although Bush never built the machine, he described it in the following manner:

> A device which an individual stores his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory. (35:816)

Two other noted hypertext pioneers are Ted Nelson and Douglas Englebart. Englebart proposed the system H-LAM/T (Human using Language, Artifacts, and Methodology, in which he is trained) in 1963 (6:22). His attempt was the first to build the memex described by Bush twenty years earlier (35:816). Ted Nelson coined the term "hypertext" during his work on the Xanadu Project in 1968 (6:23). The project's goal was to have the world's knowledge on-line for users at multiple workstations (31:169).

Interest on hypertext has grown over the last several years. Although no one reason can explain the expansion, there is certainly agreement on the role that technology has played. Improved computing power, high-resolution displays, and networking are mentioned by several authors as breakthroughs that have contributed to the widespread availability of hypertext applications (35:818; 24:21; 32:ix-x). Paul Saffo, in the article, "What You Need to Know About Hypertext," appropriately reflected on the tendency of technology to catch up with theory. He stated, "If we are in the midst of a revolution, it is one that has occurred before under other names" (31:173). According to Saffo, Owl Systems International claims that their introduction of the program named Guide in 1985 was the first commercially available personal computer hypertext system (31:171).

Other Definitions

Variations to the above explanation of hypertext exist in the literature. Smith and Weiss provided one in Communications of the ACM.

> More precisely, hypertext is an approach to information management in which data is stored in a network of nodes connected by links. Nodes can contain text, graphics,

> audio, video, as well as source code or other forms of data. The nodes, and in some systems the network itself, are meant to be viewed through an interactive browser and manipulated through a structure editor. (35:816)

This definition is replete with other key terms that deserve explanation. They are nodes, links, browse, and network.

Nodes. Nodes and links are the building blocks of hypertext systems. Schneiderman stated that a node is, "The smallest unit of information in a hypertext database to which a link can be made" (32:159). Nodes should express one idea; however, there is not consensus on their recommended size (32:6). Node length can vary from an entire book to the text that can fit on a single screen (25:12).

In her thesis, Use of Hypertext for the Development of an Office Reference System on Economic Analysis, Captain DeAnna L. McMurry provided a comprehensive review of hypertext literature. Her discussion of nodes made the distinction between article-based or card-based nodes. Article-based nodes represent single documents that the user can scroll through one screen at a time, while card-based nodes fit the text on a single screen. Captain McMurry stated that users of article-based nodes must be knowledgeable of scrolling techniques for the system to be effective. Card-based systems eliminate the associated risk of inexperienced users; however, text must be partitioned to information that can fit on a screen display (25:12-13).

Hypermedia, unlike hypertext, uses nodes that include text, graphics, digitized speech, audio recordings, pictures, animation, and film clips (5:18). This research is limited to nodes that are text. In addition, this discussion of hypertext should not be confused with an expert system. Although expert systems can incorporate hypertext

concepts, an expert system is characterized by an inference engine that can make decisions based on new information (16:846).

Links. Akscyn, Conklin and Schneiderman view links as the most important concept of hypertext systems (1:829; 5:18; 32:3). Links connect nodes (1:820), and can be thought of as, "The glue that holds hypertext together" (32:3). Karen Smith further defined links stating, "A link connects words or sentences in one electronic document to related information in another document" (36:32). When a link is selected (or activated), the node connected to it is retrieved and quickly displayed on the screen (16:837).

The designer of hypertext software can use a number of available methods to mark the presence of links. For example, highlighted or underlined words and phrases can be embedded within the text of a document (31:171; 20:312). Visual symbols called icons can also be used, and appear as graphic images on the display (32:67).

Just as there are a number of methods to embed links, there are also several means to activate a link. Use of cursor keys, mouse, track ball, or touch screen are four possible methods (20:312).

Since links connect two nodes that contain information, it is reasonable to assume that users might desire to return to the node from which they originated. The ability to return depends on whether a link is unidirectional or bidirectional. Schneiderman defines the terms in the following statements: "A unidirectional link goes in one direction only; a bidirectional link goes in both directions. A bidirectional link allows you to traverse the link from the other end" (32:4).

Links can be organized using a strict hierarchy, or network structures (32:4,7). Hierarchical links connect information that progressively grow in detail on the same subject (32:4). Tree diagrams can be used to document hierarchical links. Nonhierarchical, or network links connect more peripheral material, such as comments and cross-references (1:828). "Hierarchical" and "network" (32:4) are used interchangeably by Akscyn with "tree items" and "annotation items" (1:828).

Authoring. Authoring is the process of designing, developing, or creating hypertext systems.

Browse. To browse is to peruse information in an exploratory manner. Raymond and Tompa defined browsing as a two stage process. First, a subject area is decided on, followed by quick navigation to its location (29:872).

Graphical Browsing Systems. Graphical browsing systems are carefully developed, well-planned maps that can present graphical overviews of the network structure (16:840). By presenting the user with a "bird's-eye view" of the document structure, Karen Smith stated that browsing systems can answer questions like "Where am I?", "What information is available?", and "How can I get to it?" (36:39). Smith recommended designers of hypertext limit maps of the entire structure to smaller networks that have less than 50 links (36:40). Local maps are more appropriate for larger, more complex documents.

Application Schemes

Hypertext applications can take many forms. Some authors categorize educational applications as either a tool, tutor, teacher,

or tester (12:3-12). Authors of literature in the area of computer-assisted instruction discuss several forms that applications can take. Kemner-Richardson, Lamos, and West wrote a handbook for Air Force Instructional Managers. In it, they described six possible forms of computer-assisted instruction: 1) Informational; 2) Drill-and-Practice; 3) Tutorial; 4) Simulation; 5) Inquiry; and 6) Intelligent (19:19-24). In their research, Captain Richard Fryer and Captain Michael Sivley found the above six categories of applications as the most comprehensive (12:3-13; 34:15).

While these descriptions of computer-assisted instruction schemes are valuable, Captain McMurry's review of hypertext classifications is much more apropos. Captain McMurry recognized four dimensions of hypertext systems that were first described by Nielson. Shown in Table 1, this versatile classification scheme was designed to identify a hypertext system during any stage of development (25:20-21).

Captain McMurry also identified a method used by Conklin. Conklin combined the second and third categories of Table 1, and explained the concepts in greater detail to arrive at the classifications contained in Table 2 (25:20-21).

In Hypertext Hands On!, Schneiderman discusses hypertext schemes through an examination of how they have been applied. Examples include dictionaries, encyclopedias, medical textbooks, product catalogs, creative writing, help systems, technical documentation, instruction, software engineering, religious studies, and museum exhibits (32:20). This research does not replicate any of the above hypertext schemes.

TABLE 1

Hypertext Classification Scheme 1 (25:21)

generation	original (1945 to 1980) and current (1980s)
scope of the user target	single user, work group, corporate division, and the whole world
browsing versus authoring	information presentation versus network creation and manipulation
task specificity	general, some task specificity, and task specific

TABLE 2

Hypertext Classification Scheme 2 (25:21)

macro literary systems	. . . large on-line libraries. .. [for] all publishing, reading, collaboration, and criticism . . . within the network.
problem exploration tools	tools to support early unstructured thinking on a problem, in which many disconnected ideas come to mind . . .
browsing systems	similar to macro literary systems, but smaller scale systems for teaching, reference, and public information, where ease of use is crucial.
general hypertext technology	general purpose systems designed to allow experimentation with a range of hypertext applications--most commonly applied to reading, writing, collaboration, etc,..

Gagne stated that the classification of an application can also be based on the "learning outcome" of sessions at the computer (13:17). The Workbook is published to assist CPCM candidates organize an approach to the CPCM exam, and to provide the contents of past examinations (7:xv). The learning outcome of sessions at a

computerized version would be designed for similar purposes. This researcher has used the Workbook for informational, research, and reference purposes. Thus, the reference system proposed by this research most closely resembles a browsing system categorized within Table 2.

System Design

There is an abundance of literature that discusses the steps that have been used to develop particular hypertext applications. The researcher did not find a cookbook approach that can be applied to the design of every system. However, Ben Schneiderman provided lists of system design considerations that are based on years of experience (33;124-128; 32:62-63).

Medical Handbook and Oxford English Dictionary. In the article "Searching for Information in a Hypertext Medical Handbook," Mark Frisse recounted four steps that he and others used to convert a medical textbook into a hypertext manual. The manual was first partitioned into individual cards based on the inherent hierarchical structure of the text. Second, the first six words of sections were assigned a card title. Structural links between each card and its parent were created third. The design of indexing and retrieval methods finalized the process (11:881).

In their article, "Hypertext and the Oxford English Dictionary," Raymond and Tompa described system design as an overall problem of defining text fragments and the associated links (29:871). It appears that these authors combined Frisse's steps into one overall task. Raymond and Tompa also recommended careful examination of the

conventional document's structure and consultation with experienced professionals if possible (29:871).

System Design Steps. Hypertext is a new concept, and every project is unique. Designers apply their experience and training while authoring systems, and final products are representative of each author's style. Although the process can be considered both an art and a craft, Ben Schneiderman provided a comprehensive list of considerations in Hypertext Hands On! that deserve mentioning here.

1. Chunking - The information to be presented needs to be organized into small "chunks" that deal with one topic, theme, or idea. Each chunk represents a node or document in the database.

2. Interrelationships - Each document should contain links to other documents. The more links contained in the documents, the richer the connectivity of the hypertext database. On the other hand, avoid gratuitous links - each link should serve a clear purpose.

3. Consistency of document names - It is important to keep a list of names given to documents as they are created; otherwise, it becomes difficult to identify links properly. Synonyms are to be encouraged (as long as they are kept track of).

4. Master reference list - Create a master reference list as you author to ensure correct citations and prevent redundant or missing citations.

5. Simplicity in traversal - Navigation should be simple, intuitive, and consistent throughout the system. Movement through the system should be effortless and should not require thought.

6. Screen design - Screens should be designed so they can be grasped perceptually. Visual layout is very important in screen design.

7. Low cognitive load - Minimize the burden on the user's shortterm memory. Do not require the user to remember things from one screen to another.

8. Early reviews - Subject the database to technical, legal, and management reviews as early as possible. As the

database becomes larger, changes become more difficult to make.

9. Maintain multiple perspectives - When authoring, try to balance the technical requirements of the system with the user's perspective and the organizational use of the database. (32:62-63)

Authoring hypertext systems is an iterative process that might involve all or some of the above steps. In addition to these strategies, there are a number of important issues that should be considered during the overall design process.

Ease of Use. The technology that was the genesis of interest in hypertext systems also presents dangers that can limit their effectiveness. High resolution displays, enormous processing power, networks, the ability to link across large databases, and audio/video sequences are a few attributes of hypertext technology. If used improperly, the result could be poorly designed products that scare people away (15:38). Rossett directly addressed faddish additions like graphics or video to instructional programs that add considerable expense. He recommended that a rational examination of these expensive, technological improvements should be made first to determine if the gains can justify the costs (10:43).

In light of the above discussion, a number of authors recommend ease of use as a primary goal for any hypertext system (1:834; 5:38; 10:43; 15:38; 20:314; 35:22). The linking ability that makes hypertext unique also presents an inherent danger. The power that allows quick navigation through a document can confuse users to the point where they are "lost in space" (15:38; 32·49). The disorientation described here is usually due to a lack of sufficient information of a user's current

location relative to the overall structure of the document (32:49). Raymond recommends careful planning of the document's structure during the early design stages to improve user orientation (29:871). There are also a number of mechanisms that can be used for the same purpose. Graphical browsers, indexes, bidirectional links, and bookmarks are a few examples of tools that are available to the author. Bookmarks are electronic markers that allow a user to return directly to a marked location in a system (32:14).

User frustration can also be avoided by designing a system that responds quickly. Akscyn recommended fast link selection response times (of less than .25 seconds) to best reduce mental fatigue, time, and physical effort (1:828). He stated, "We believe the ability to browse quickly in a hypermedia system is critical to its usability" (1:830). A caveat here is to beware of making link response too fast, otherwise novices will not recognize screen changes (32:39).

Summary

This chapter first discussed professionalism in contracting from a historical perspective. Because of laws like the Defense Acquisition Workforce Improvement Act, more and more people will be pursuing continued education in contracting, and professional recognition through programs like the Certified Professional Contracts Manager.

Hypertext was the second topic discussed in this chapter. The history, pertinent definitions, application schemes, and system design were all addressed. Hypertext authoring tools offer great versatility. However, experienced authors recommend rational decisions be made in order to avoid unnecessary cost, time, and complexity.

Although there are no standard steps to follow to create a hypertext document, general guidelines are available. It is up to the individual to tailor a system to the intended user while keeping overall design issues in mind.

III. Methodology

Introduction

This chapter begins by first describing the general method employed to solve the research problem and the rationale for its use. The five objectives introduced in Chapter I are then addressed. Once again, the objectives were: 1) Obtain permission to create a hypertext version of NCMA's CPCM Candidate's Workbook and Supplements; 2) Select and purchase the software; 3) Develop the hypertext model; 4) Test and evaluate the hypertext system; and 5) Implement feasible improvements. The objectives are discussed in light of the methodology used to accomplish the specific research problem.

Research Method

Prototyping was the general method used to structure the software development process. Prototyping was chosen since it is a method that researchers can use to quickly determine the feasibility of a model, and then test its usefullness. Objectives two through five embrace the prototyping effort. Objective one began the research because the other objectives were contingent upon obtaining copyright permission. The paragraphs below will explain the requirement for obtaining copyright permission in more detail.

The general method employed to solve the specific problem was modeled after the procedures used by Captain McMurry, and was tailored to meet the needs of this research (25). For a detailed discussion of prototyping and life-cycle models, the reader is referred to her thesis (25:38-54).

Objective 1: Obtain Copyright Permission

The potential of hypertext applications has been described as immeasurable. However, the individuals who have theorized global libraries of text have also introduced copyright law issues and questions. According to Schneiderman, "Copyright law is designed to protect the intellectual rights of an author on original works and all derivations" (32:53).

Henry Jones, who wrote "Developing and Distributing Hypertext Tools: Legal Inputs and Parameters," discussed the five rights protected by copyright law. According to Jones,

> The importance of copyright law to the development of hypertext tools is underscored by the fact that this portion of federal law regulates not merely the right to reproduce a work (e.g. to "copy"). In fact, a copyright is a bundle of five distinct, severable rights. The other four are the right to adapt or modify a work (i.e., to create a "derivative work"), and the rights to publicly distribute copies of a work, to display it (e.g., on a computer terminal), or to perform it. (18:368)

Jones summed his article up with the following advice:

> The moral: if you plan to reproduce, modify or display the code, proprietary structure and design, or documentation of another developer, you may need a written license agreement. In any event, early discussion and coordination with copyright counsel, based on a specific review of both your planned activities and the materials originally created by third parties, can help identify your obligations and rights. (18:370)

This research was limited to the conversion of one document (and its supplements) into hypertext format. The following statement is found on the first page of the CPCM Candidate's Workbook:

> Copyright 1987. All rights reserved. Reproduction in any form expressly prohibited. No part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the

prior written permission of the National Executive Director of NCMA. (7:i)

Thus, the attainment of permission from NCMA was a vital first step.

Objective 2: Select and Purchase Hypertext Software

The second objective was to identify the important characteristics of hypertext software needed for this research. The choices were limited to those that run on the MS-DOS operating system software. NCMA Headquarters uses this operating system, as does the Air Force Institute of Technology.

Since links and nodes are the key attributes of hypertext, authoring systems should manage these two issues effectively (33:121). Indexes of nodes and links, in addition to the efficient manipulation of these items are also of great value to a hypertext authoring system (33:121). In addition to these features are several others:

- range of editing functions available (i.e., copying, moving, insertion, deletion, global change within an article, etc.).

- the availability of lists of link names, index terms, synonyms, etc.

- the range of display formatting commands available.

- the availability of search/replace functions for making global changes across multiple nodes.

- control of color (text,background): color can make the text look attractive, but it can also be distracting. Since users are very different in their preferences and tasks, it should also be possible for users to reset color usage parameters.

- the capability to easily switch between author and browser modes to test ideas.

- accessing CD-ROM, videodisc, or other devices: new devices are emerging regularly with remarkable storage

capabilities. It should be possible to access information on a variety of devices.

- capability to export files to other systems.

- operability on a local network.

- multi-user, network & distributed databases.

- version keeping (can old versions of an article be stored?).

- graphics & video facilities: are there embedded graphics editors and mechanisms for exploring the videodisc.

- collaboration: can more than one person edit the database at one time? Can components of the database written by several people be merged into one hypertext database.

- data compression: compression algorithms can reduce the size of the database and facilitate distribution of disks or dissemination by electronic networks.

- security control: is there password control for the database or parts of it.

- encryption: can sensitive nodes be encrypted?

- reliability: does the software perform without bugs, and without losing data?

- integration with other software/hardware.

- browser distribution: does every user of the hypertext have to acquire a copy of the full system or can the browsing part be included with the database. (18:121-124)

The above criteria were considered by Captain McMurry during her research. The following eight were considered important by Captain McMurry for the development of her prototype: index of nodes, easy management of links, wide range of editing functions, capability of easy switching between editor and browser, version keeping, data compression, reliability, and browser distribution (25:44). Similarly, several of the features were given special interest by this researcher.

They included easy management of nodes and links, editing functions, data compression, integration, and reliability.

Three other issues were considered before the final selection of a hypertext system. The first was the need for a royalty-free runtime. Runtime programs are a limited version of the complete hypertext system software. Large numbers of users can use runtime programs without having to purchase the entire authoring software. The second issue was the need for a familiar editor or word processor style interface. This was due to the fact that the researcher lacked programming skills. In addition, time constraints demanded a short learning curve for becoming proficient in the use of the authoring system.

Objective 3: Develop the Hypertext Model

The topic of system development was researched in the hypertext literature. In addition to the system design considerations listed in Chapter II, the following are seven more recommended by Ben Schneiderman:

1. Build the project around the structuring and presentation of information, not around the technology. Make sure that the structure matches users' needs.

2. Develop a high concept of clear (simple, clear, bold idea) for the body of information you are organizing. Avoid fuzzy thinking when creating the information structure.

3. Keep the navigational structure simple and intuitive. Find a simple, comprehensive, and global structure that the user can easily develop into a cognitive map.

4. Each screen should be self-contained and should not require the user to search his or her memory to understand it or navigate from it. Be sensitive to the possibility that the user will get "lost in hyperspace," and develop the system so recovery is simple.

5. Keep the user's effort very low. Realize that the user is allocating attention among multiple tasks: navigation, processing the content of the database, and attending to the business at hand.

6. Users are your best source of feedback; use them throughout the development process to test your designs. Realize that you are not a good judge of your own design because you know too much.

7. Study the target population of users carefully to make certain you know how the system will really be used. Create demonstrations and prototypes early in the project; don't wait for the full technology to be ready. (32:124)

Broad objectives like those found above are targeted for use throughout the development process. They do not provide a systematic, sequential approach for the inexperienced author. Review of the literature revealed a lack of step-by-step approaches for development of hypertext documents. There are two reasons for this. First, hypertext itself is a developing technology. Second, each application is unique, and a standard approach for each is simply impossible.

Three steps were used to structure the software development effort. The first step was to design the software structure on paper. Second, the text was converted to machine readable format. Third, methods were developed to present the information to the user.

Objective 3a - Structure. The introductory screen of a hypertext system often displays the document's structure. Preplanning the document structure can lead to a better designed access tool. Upon entering a hypertext program, users must be able to decide where to branch to get information of interest. This activity should be able to be performed with a minimum amount of confusion. Hypertext structure is implicit; the system should clearly define the structure for the user. An explicitly designed approach can make a system useful to a

new user in a matter of minutes, while repeated use of the system helps reinforce the structure.

The need for preplanning the document structure also stems from a practical perspective. Changing the link structure of a document well into the development phase can result in frustration and an increase in development time. Captain McMurry reconsidered the link structure after importing ASCII files while creating an office reference system on economic analysis. She reflected that substantial time could have been saved if more time had been spent preplanning before importing the text (25:58).

The introductory screen discloses a document's structure, and is a key design issue. One author condensed several approaches that have been used into three separate strategies.

> 1. Make the root document an overview that contains links to all major concepts in the database [glossary strategy].
>
> 2. Adopt a hierarchical approach in which the links in the root document are major categories [top-down strategy].
>
> 3. Organize the root article as a list or table of contents of the major concepts in the database [menu strategy]. (32:126)

The most appropriate strategy is determined by the purpose and use of the hypertext document.

The Workbook and Supplements which were converted to hypertext are well structured documents. In addition to the introductory material, the Workbook is comprised of nine categories. The categories are: required, general, legal, financial, production, contracting, logistics, commercial, and state/local. The hierarchical approach appeared to be best suited for this application. The actual document

resembles a hierarchy of past exam questions, and a replicated hypertext version would be familiar to those users who have used the Workbook.

Objective 3b - Text Conversion. Again, the literature regards the conversion of text into machine readable format to be a major concern for hypertext developers (32:127). Text conversion has become more feasible through the use of microcomputers, and standard ASCII files. Hypertext authoring systems that can import ASCII text files provide for efficient development, because the step of link identification can follow much more quickly.

Converting large documents into ASCII files requires the use of a scanner. In order to avoid monumental editing tasks, past hypertext developers recommend investment in the best quality scanning equipment possible (25:58).

Objective 3c - Method of Presentation. The third step was to develop a method to present the information to the user. There were three major decisions that had to be made in order to meet this objective. The first was to determine whether to use an article-based or card-based metaphor. The second decision was to decide on which combination of organizational and content nodes to use. The final decision was to ascertain which commands to include in a control panel that was included at the bottom of every screen. Each of these areas are discussed in greater detail below.

Article-Based or Card-Based Metaphor. Article-based and card-based metaphors are the two primary methods used to present information to users of hypertext.

"Article systems utilize the metaphor of presenting information to the users as an article - continuous text that scrolls onscreen" (28:5). Scrolling is a technique that is used to view documents that are converted to article-based metaphors. The page-up or page-down key is used to view the text, much like a person turns the pages of a book. This type of system is only effective if users think to scroll down for further information (28:5). Otherwise, the information is considered inaccessible.

The second type of metaphor is a card-based system (28:5). Card-based systems present information through the use of an index card metaphor. Scrolling problems are eliminated since each window is limited to the information that can fit on a single screen.

Organizational or Content Nodes. The second decision was to determine which combination of organizational and content nodes to use.

Organizational nodes are used as reference points for users. They can contain information such as an index, table of contents, table, or figure listings. These types of metaphors are valuable in linear texts, and shouldn't be abandoned when creating hypertext (28:21-22).

Content nodes contain the information of the linear document. Links located in an organizational node would be connected to content nodes where the substance of a document is located (28:22).

Control Panels. The final decision was to determine which commands to include in a control panel. A control panel is a useful tool that is located at the bottom of every screen, and includes

commonly used navigational commands (28:155). A few of the choices inside a control panel could be: Cover Page, Index, Next, Previous, or Exit. Users depend on the commands to perform routine tasks without having to memorize commands or return to an organizational node. Control panels take up to four to five lines of screen space; however, they are considered valuable tools that outweigh the loss of a few lines (28:156).

Objective 4: Testing/Evaluation

The fourth objective was to receive feedback on the hypertext system. A questionnaire was used as the primary method of collecting data, and is shown in Appendix A.

The questionnaire was modeled after one developed by Captain McMurry who used the questionnaire to test the macro level of acceptance of the system (25:90-92). Testing for macro acceptance was appropriate in order to assess the initial success of the design characteristics (25:52-53). The questions were structured to measure " . . . ease of learning, low error rates, and subjective satisfaction" (25:53).

> Ease of learning refers to the time required to learn the commands to use the system; error rate refers to the errors made in carrying out a specified set of tasks; and subjective satisfaction refers to how much users liked the overall aspects of the system. (25:53)

Volunteers were solicited from the Air Force Institute of Technology, and were given the opportunity to complete the questionnaire at their personal residence. Time constraints were not given for evaluation of the model or completion of the questionnaire.

Since the population included individuals with contracting backgrounds, the instrument also included questions that measured the desire to possibly purchase the program at some point in the future from NCMA.

Objective 5: Implement Feasible Improvements

The final objective of the research was to implement improvements that were identified during the testing and evaluation phase.

Summary

Chapter III described the objectives that guided the research effort. The first objective was to obtain permission from NCMA to automate the CPCM Candidate's Workbook. The second objective was to identify and purchase hypertext software that met important criteria. The third objective was to develop the hypertext software once the authoring tool was purchased. This involved three steps: 1) design of the structure; 2) conversion of the text into machine readable format; and 3) development of a method of presentation. The fourth objective was to test and evaluate the hypertext model. The final objective was to improve the system based on feedback from the questionnaires.

IV. Results

While Chapter III described the five objectives that guided the research, this chapter reports how the five objectives were actually performed during the development process.

Objective 1: Obtain Copyright Permission

The receipt of copyright permission was the critical first step of the methodology in order to comply with copyright law and to protect the rights of the original author of the Workbook and Supplements. Permission was granted in writing by the Executive Director of the National Contract Management Association to reproduce the Workbook for the purpose of creating a computerized version (14). A copy of the letter is located at Appendix B. In addition to granting copyright permission, the letter reveals the hopes of NCMA to receive a finished product that would be worthy of contributing to NCMA's Educational Product offerings (14).

Objective 2: Select and Purchase Hypertext Software

HyperWriter (TM) was the authoring system used to support this research. The application was chosen based on a number of criteria that were discussed in the previous chapter. In addition, the previous research of Captain McMurry was considered during the selection process.

Captain McMurry compiled a list of hypertext systems along with the address and telephone numbers of the companies that sell them (25:89). Each system was reviewed against the important criteria that

are listed in Chapter III. HyperWriter was chosen by this researcher because it best fulfilled the following criteria:

1) HyperWriter runs on MSDOS.

2) HyperWriter offers a royalty-free runtime.

3) HyperWriter uses a familiar word processor style interface that precludes the use of complex programming skills.

4) The use HyperWriter is simple enough to learn without formal training in order to author hypertext systems in a limited amount of time.

Captain McMurry considered the first, third, and fourth criteria to be important during her selection process, and selected HyperWriter for her research (25:55).

The manufacturer of HyperWriter (NTERGAID) was contacted prior to the purchase of the software to discuss the use of the authoring system for the specific purpose of this research. The staff at NTERGAID felt confident that HyperWriter could be used to develop a hypertext version of the Workbook. In addition, a HyperWriter demonstration diskette was reviewed to get a "hands-on" feeling for the system. All of the above factors contributed to the selection of HyperWriter for this research.

Objective 3: Develop the Hypertext Model

The researcher originally planned to develop the hypertext model by following the objectives from Chapter 3 i sequence. The following were the steps: 1) determine the structure; 2) convert the text to standard ASCII files; and 3) to develop the method of presentation. All three of the steps were performed during the development of the actual hypertext system, but not necessarily in that order. For

example, several iterations of steps one and three were performed, while the conversion of text to standard ASCII files (step 2) was accomplished only once.

As mentioned earlier, the Workbook consists of nine areas of concentration that each contain past examination questions presented in a standard format. In order to save time, an initial system was developed that contained only one area of concentration. Once an initial model of the system was completed, the development process was repeated for the other eight areas of concentration. Macros were used wherever possible to minimize the time required to replicate the original files, and to standardize the file format (spaces, window margins, text, etc.).

The following paragraphs discuss the three steps of the development process in detail.

Objective 3a - Structure. After HyperWriter was purchased, approximately twelve to fifteen hours were spent reading the manuals and getting familiar with the features of the authoring system. Once a basic understanding of HyperWriter and its abilities were achieved, the researcher designed the document's structure on paper. The initial drawing served as a starting point to allow the other steps to progress. Several changes were made to the structure during the development process, and Appendix C illustrates the final layout of the system.

The presentation of information must meet a user's needs, and a system's value is dependent upon a navigational structure that is clear and intuitive (32:124). Thus, the map of the system proved to be an

essential element of the research. The researcher tested numerous designs on the user before a final layout was achieved. Meaningful changes were even made during the latter part of the development process. The changes to the structure made a significant contribution toward the development of a cognitive map. The latter changes were based on the feedback of an individual who was not previously familiar with the research. The following statement made by Schneiderman was definitely worth consideration: "Realize that you are not a good judge of your own design because you know too much" (31:124).

Objective 3b - Text Conversion. Conversion of the text to standard ASCII files was a repetitive and time-consuming. The conversion process actually took two separate phases. First, the Workbook and Supplements were scanned one page at a time. Second, the text was imported into a text editor to remove spelling errors.

The entire Workbook and Supplements were scanned over a matter of 17 hours. The editing process was prolonged due to errors introduced by the scanner used by the researcher. For example, the scanner read one's as lower-case L's, zero's as O's, and it included random characters such as \? throughout the text. Editing of the text took approximately 50 hours total.

Objective 3c - Method of Presentation. Every hypertext application presents information to the user differently. Three decisions had a major impact on the particular method of presentation used by the final hypertext system. Determinations were made regarding the type of metaphor to use (card-based or article-based), the

combination of nodes to use (organizational and content), and the commands to include in a control panel at the bottom of every screen.

Early attempts to design the initial document involved experimentation with all three major decision areas. It was impossible to determine one method of presentation without effecting the others. The document took nearly 95 hours to develop. Approximately two-thirds of the total time was used to design the initial system, while the remainder involved the creation of the other eight areas of concentration. Each of the three decision areas are discussed in detail below.

Article-Based or Card-Based Metaphor. The decision to use an article-based or card-based metaphor was critical. Once the text was converted to ASCII files, a determination had to made regarding how the questions would be broken down. A card-based metaphor is much more difficult to design than an article-based one because all of the information must be broken down into chunks of text that fit on a single screen (28:20).

The researcher decided to use an article-based metaphor. The decision was based primarily on the size of the questions (number of lines) contained in the Workbook, and the availability of a feature offered by HyperWriter. A great number of the CPCM questions and their corresponding answers would not fit on a single screen. HyperWriter has a feature that deals with this problem, enhancing the use of article-based systems. A scroll bar automatically appears on the right side of the screen when the contents of a node are longer than the number of lines that fit on a screen. The scroll bar signals to the

user that more information stretches below the screen. Mouse users can click on the scroll bar to quickly view the data. Users who don't possess a mouse strike the "Page Dn" key to perform the same function. Overall, the feature ensures that users realize that more information extends below what is currently displayed.

Organizational or Content Nodes. The correct combination of organizational and content nodes was sought in order to make navigation through the document quick and efficient. The final document consists of ten files. One entire file is essentially an organizational node, and includes a "Master File Menu" (table of contents). The other nine files correspond to the nine areas of concentration. Each file opens with an organizational node that directs the user to standard menu choices. Content nodes contain workbook questions, instructions, and information about the Workbook. To examine the actual use of organizational and content nodes in greater detail, the reader is referred to Appendix C.

Control Panels. Control panels offer readers common navigational commands at the bottom of every screen (28:155). HyperWriter does not support control panels in article-based systems. However, common navigation commands were positioned at the bottom of every organizational node and directly after each question. Appendix C also displays the standard question format and the common navigational commands for each question.

Objective 4: Testing/Evaluation

The hypertext system was tested once by contracting management students from the Air Force Institute of Technology's class of 91S.

Ten out of 12 students responded to the questionnaire. The results of the questionnaire are located in Appendix D.

The results reveal that the majority of the students were knowledgeable about computer operation, and had no problems installing the software on their computers. This should be representative of individuals who would desire to purchase the software from NCMA. It seems reasonable that individuals wouldn't purchase diskettes unless they have sufficient knowledge about computers required to install programs.

All of the students agreed that the cover screen provided adequate instructions required to activate menu choices. All of the users read the instructions which are accessible from the cover screen, and 80% agreed that they felt confident using the document after doing so. With the instructions that were available, 90% agreed that a paper users manual is not required.

The intention of the researcher to provide the user with a simple program received favorable results. All of the students reported that the system was easy to use, and 90% found the system easy to learn. None of the students got lost. Menu choices and displays were the most popular feature of the program, while the depth and breadth of data available was the least liked feature.

The interest of the program is hard to predict based on the responses to the question regarding the preference to use the hypertext version of the Workbook. Several students have never seen the actual Workbook, and could not make a comparison between the two.

One question specifically asked whether the feature named Readers Notes functioned correctly when activated. Readers Notes offers the user the ability to add their own notes or outlines to any window in a hypertext document. The researcher experienced problems with the function during the development process. When activated, it caused the keyboard to lock up, and the computer had to be restarted. Seventy percent of the students experienced similar problems. For this reason, Reader's Notes were not incorporated in the final document.

Several students wrote general comments on separate sheets of paper. These are listed in Appendix E.

Objective 5: Implement Feasible Improvements

Revisions to the hypertext system were performed after the questionnaire was administered. The improvements primarily focused on standardizing the nine areas of concentration, and correcting spelling errors. Direct access to Reader Notes from the document was also removed as a result of the problems discussed above. Feedback from the questionnaire also resulted in a map of the system's structure to be provided with the installation instructions in order to give users a general understanding of the program's layout.

Summary

This chapter presented the results of the researcher's efforts to meet the objectives set out in Chapter III. Copyright permission was obtained as a first step. Second, HyperWriter was purchased from NTERGAID because it met four important criteria.

The third phase was the bulk of the effort. Once the researcher completed an initial drawing of the system's structure, the entire text was converted to standard ASCII files. After hours of experimentation with HyperWriter, an article-based system was developed that uses a combination of organizational and content nodes, in addition to menu choices that are similar to control panels.

The hypertext document was tested in accordance with objective four, and the results of the test/evaluation reveal that the hypertext program was easy to learn and use. Improvements to the document were implemented as a fifth and final step in the research.

V. Conclusions and Recommendations

The purpose of the research was to develop and test a hypertext version of the CPCM Candidate's Workbook and three Supplements. Five objectives structured the research effort: 1) Obtain permission to create the hypertext workbook; 2) Identify the important features of hypertext authoring systems needed for the research; 3) Develop the hypertext model; 4) Test and evaluate the hypertext model; and 5) Implement improvements to the hypertext system that were identified during the testing stage.

Chapter I introduced the research and stated its specific purpose, which was to develop and test a hypertext version of the CPCM Candidate's Workbook and Supplements. Chapter II was a detailed discussion of professionalism in contracting, and issues regarding hypertext. Chapter III explained the five objectives that defined the methodology that was used to develop and test a hypertext workbook. Chapter IV used the five objectives defined in Chapter III as a forum to answer how they were actually carried out during the software development effort. Chapter V presents the conclusions from the research and suggests recommendations for further research.

Conclusions

A complete hypertext model of the four publications was developed by the researcher, and tested by AFIT graduate students. The research has shown that an electronic form of the CPCM Candidate's Workbook can be developed using a hypertext authoring program. The evaluation demonstrated that individuals can install the hypertext system on their

personal computers, and quickly learn to use it. The cross reference of questions to their corresponding key points takes less than a second.

The researcher developed the hypertext document with an authoring system that was chosen based on a number of important criteria. The researcher possessed limited experience on personal computers, and was able to become proficient in the use the authoring system in a small amount of time. Although the use of HyperWriter was compatible with this research, there are a number of other software packages on the market that offer educational discounts. A complete analysis between a developer's needs and the features of a system should be made before the selection of future systems.

Based on this research, every effort should be made to dedicate time up front to the design of a logical document structure. Development of the hypertext document did not occur in distinct phases; however, the research advanced at a much quicker pace once a coherent structure of the document was completed. The time required to complete a hypertext document increases at an alarming rate if the structure is changed late in the development process. This is due to the impossibility of cutting and pasting hypertext links.

A document should be analyzed prior to an attempt at converting it to hypertext. The font size, graphics, underlines, and several other factors affect the ability to scan text. In addition, the highest quality scanner should be used during the conversion process. Because it is easy to underestimate the time required to scan and edit

documents, sample pages should be scanned and edited prior to committing to a development effort.

Recommendations

Three recommendations are presented here. Two describe possibilities for further research. The first recommendation is to test and evaluate the hypertext workbook across a broader population of NCMA members. Potential users of the system include a vast population of civilian and military contracting personnel across the country. It is unknown how many users would be interested in a hypertext workbook that operates on other than MS-DOS operating systems. The desire for a document that runs on Macintosh computers might exist. Predictions of the document's usefulness could be made with greater confidence if the system was tested across a greater sample of the population.

The second recommendation is to expand the depth and breadth of the data available in the current system. As one example, unique contracting terms in the hypertext document could be linked to their associated definitions. Two sources of terms could be used to support this effort. The first is the Desktop Guide to Basic Contracting Terms offered by NCMA as one of their Educational Product Offerings. The other source is the research based accumulation of acquisition and contracting terms gathered as a result of the efforts of graduate students from the Naval Postgradu[illegible] School and the Air Force Institute of Technology. Such an effort would greatly enhance the hypertext document, and make practical use of the two sources of terms.

In accordance with Appendix B (NCMA letter granting copyright permission), the completed hypertext model was turned over to the

National Contract Management Association. The final recommendation of this research is for NCMA to market the product as part of their Educational Product offerings.

Appendix A: Questionnaire

Please rate the questions according to the following scale:
1 - strongly agree
2 - agree
3 - neutral
4 - disagree
5 - strongly disagree
N - not applicable

1. I consider myself knowledgeable about general computer operation.
   1 2 3 4 5 N

2. I had no problems installing the software onto my computer.
   1 2 3 4 5 N

3. The opening screen of the prototype was self explanatory.
   1 2 3 4 5 N

4. The opening screen instructions allowed me to activate menu choices.
   1 2 3 4 5 N

5. I read the program's instructions that were available from the cover screen. yes no
   (if no, skip to question 6)

   a. After reviewing the instructions I felt confident using the prototype. 1 2 3 4 5 N

   b. With the instructions that were available, a users manual is not required. 1 2 3 4 5 N

6. This system was easy to learn. 1 2 3 4 5 N

7. The system was easy to use. 1 2 3 4 5 N

8. I got lost (i.e., was not sure where I was within the document.)
   1 2 3 4 5 N

9. For the amount of time spent, I could learn more about the exam by using this application as compared to the paper version of the Workbook.
   1 2 3 4 5 N

10. The features I liked about the system:
    (You may select more than one response)
    a. displays (use of color, screen organization, contextual info).
    b. functions (what things you can do with the system).
    c. menu choices (how you get from one place to another).

d. speed of processing (how fast the computer does things).
e. instructions (on how to use the system).
f. data (the text used in the system).
g. depth and breadth of data available.

11. The following features of the system need to be improved:
(You may select more than one response)
a. displays (use of color, screen organization, contextual info).
b. functions (what things you can do with the system).
c. data links (how you get from one place to another).
d. speed of processing (how fast the computer does things).
e. instructions (on how to use the system).
f. data (the text used in the system).
g. depth and breadth of data available.

12. I used the program for:
a. less than 30 minutes.
b. 30 minutes to one hour.
c. one to two hours.
d. more than two hours.

13. I would prefer using this program over the paper version of the Workbook.
1 2 3 4 5 N

14. I tested the prototype on a computer that had the following features:

a. Processor: 8088/6 80286 80386 Don't Know

b. Math Coprocessor: Yes No Don't Know

c. Display: CGA EGA VGA Don't Know

d. Memory: 640K 1Meg other_____ Don't Know

15. I tested the READERS NOTES feature of the program yes no
(If no, skip question 16).

16. The READERS NOTES feature of the program:
worked fine caused the keyboard to lock up

17. If you have any other general comments, please record them on a separate sheet of paper.

(25:90-92)

Appendix B: Letter Granting Copyright Permission

January 8, 1991

Capt. Dean McLain
5797 Gross Drive
Dayton, OH 45431

Dear Capt. McLain:

You are hereby granted permission to create an interactive computerized study tool based on NCMA's CPCM Candidate's Workbook and its Supplements.

It is our understanding that NCMA will be given full rights to reproduce and sell the computer diskette and user's guide resulting from this effort.

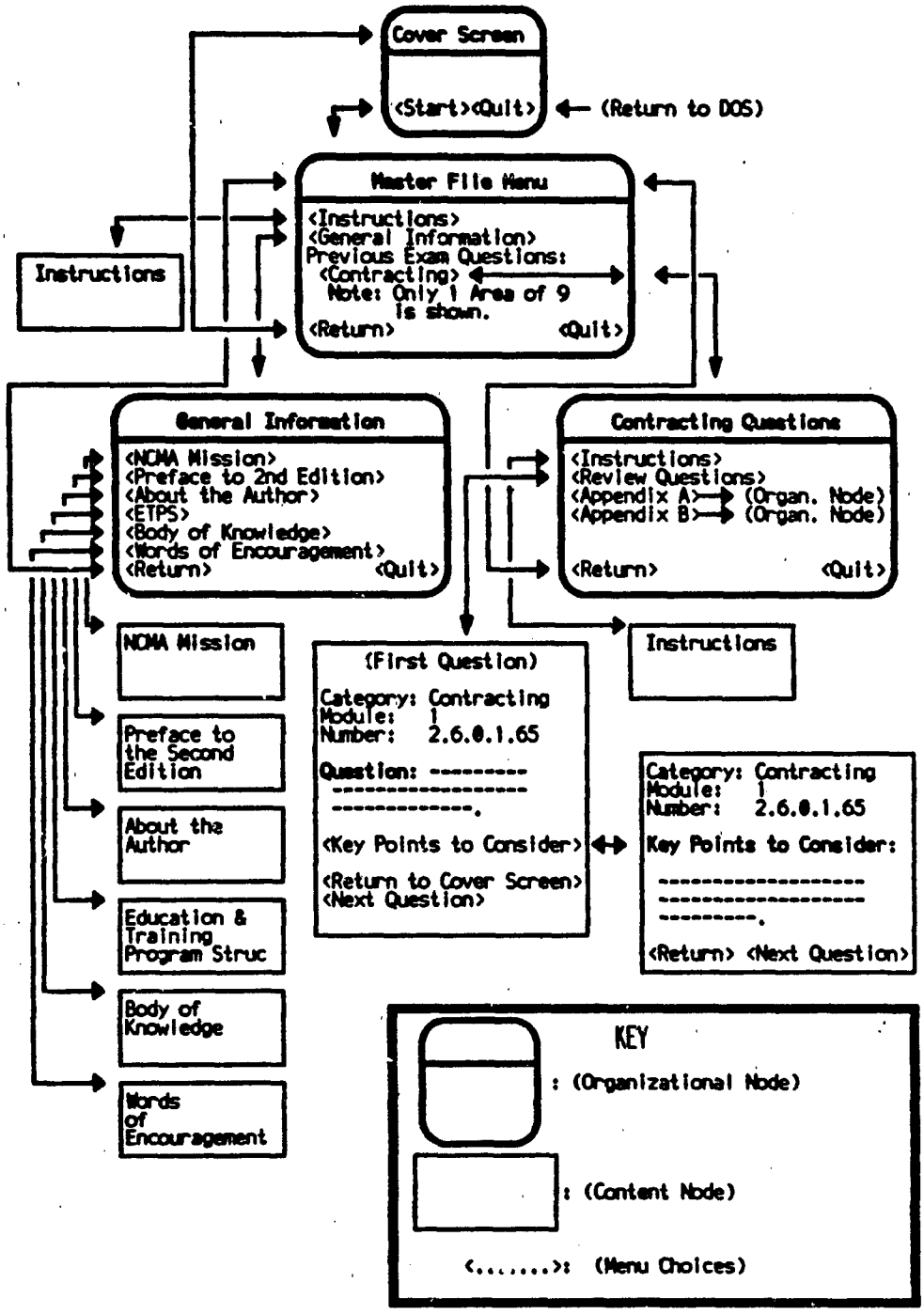
Reproducing all or portions of the Workbook and Supplements for the above purpose will not violate NCMA's copyright.

This product will be a major contribution to NCMA's Educational Product offerings. Thanks so much for your dedication and expertise in this effort!

Sincerely,

James W. Goggins, CPCM
Executive Director

Appendix C: Structure of CPCM Candidate's Hypertext Workbook



Appendix D: Questionnaire Results

The following scale was used to rate the questions:

1 - strongly agree
2 - agree
3 - neutral
4 - disagree
5 - strongly disagree
N - not applicable

The numbers below represent the percentage of people (out of 10) who gave the indicated rating.

1. I consider myself knowledgeable about general computer operation.

1	2	3	4	5	N
30%	50%		20%		

2. I had no problems installing the software onto my computer.

1	2	3	4	5	N
70%	30%				

3. The opening screen of the prototype was self explanatory.

1	2	3	4	5	N
50%	40%	10%			

4. The opening screen instructions allowed me to activate menu choices.

1	2	3	4	5	N
60%	40%				

5. I read the program's instructions that were available from the cover screen. (if no, skip to question 6)

yes	no
100%	

   a. After reviewing the instructions I felt confident using the prototype.

1	2	3	4	5	N
50%	30%	20%			

   b. With the instructions that were available, a users manual is not required.

1	2	3	4	5	N
40	50%	10%			

6. This system was easy to learn.

1	2	3	4	5	N
50%	40%	10%			

7. The system was easy to use.

1	2	3	4	5	N
40%	60%				

8. I got lost (i.e., was not sure where I was within the document.)

1	2	3	4	5	N
		20%	30%	50%	

9. For the amount of time spent, I could learn more about the exam by using this application as compared to the paper version of the Workbook.

1	2	3	4	5	N
10%	30%	40%			20%

10. The features I liked about the system:

(Note: The individuals could select more than one response for this question. Therefore the percentages are based on the total of 26 responses for this question.)

19% a. displays (use of color, screen organization, contextual info).
12% b. functions (what things you can do with the system).
27% c. menu choices (how you get from one place to another).
12% d. speed of processing (how fast the computer does things).
8% e. instructions (on how to use the system).
15% f. data (the text used in the system).
8% g. depth and breadth of data available.

11. The following features of the system need to be improved:

(Note: The individuals could select more than one response for this question. Therefore the percentages are based on the total of 12 responses for this question.)

a. displays (use of color, screen organization, contextual info).
17% b. functions (what things you can do with the system).
17% c. data links (how you get from one place to another).
17% d. speed of processing (how fast the computer does things).
17% e. instructions (on how to use the system).
8% f. data (the text used in the system).
25% g. depth and breadth of data available.

12. I used the program for:

30% a. less than 30 minutes.
60% b. 30 minutes to one hour.
10% c. one to two hours.
d. more than two hours.

13. I would prefer using this program over the paper version of the Workbook.

1	2	3	4	5	N
10%	50%	10%	10%		20%

14. I tested the prototype on a computer that had the following features:

a. Processor:

8088/6	80286	80386	Don't Know
10%	30%	50%	10%

b. Math Coprocessor:

Yes	No	Don't Know
10%	70%	20%

c. Display:

CGA	EGA	VGA	Don't Know	Monochrome
		80%	10%	10%

d. Memory:

640K	1Meg	2Meg	4Meg	Don't Know
30%	30%	10%	10%	20%

15. I tested the READERS NOTES feature of the program (If no, skip question 16).

yes	no
100%	

16. The READERS NOTES feature of the program:

worked fine	caused the keyboard to lock up
30%	70%

Appendix E: Additional Comments from Questionnaire

1. Memory

a. Seems to use a lot of memory. I ran out of memory the first time I used it while I had a DOS shell and some TSR programs loaded up. I normally have enough memory to run most software, such as Wordperfect, Windows applications, Quattro Pro, DBase, and so on.

b. Program is a memory hog.

2. Use

a. Would it be possible to select choices by number, rather than moving a cursor around the screen? I found that a little laborious at times.

b. Getting around in the program was not hard. What was difficult was figuring out what the "big picture" was. What am I supposed to do with it? What kind of answers do they expect on the CPCM?

c. If I memorized the Key Points to Consider and regurgitated them on the exam, would I pass?

d. Do I really need to go off and read the references? If I read the references and then answered in my own word in essay format, including key points, would that be all?

e. Is there any way to move to a specific question number within a module without starting from the first question and highlighting "Next Question" until I get there? This would be useful if someone does not do the whole module in one sitting.

f. Is there any way to print besides using print screen? It would be nice to print the Question, Key Points to Consider, and Readers Notes. Overall, it looks good.

g. I like it.

h. Why does pressing Enter, F1, or the mouse do the same thing?

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Vita

Captain Dean P. McLain was born on 17 March 1964 in Madison, Wisconsin. He graduated from Chelmsford High School in Chelmsford, Massachusetts in 1982 and attended the U.S. Air Force Academy, graduating with a Bachelor of Science in Management in 1986. Upon graduation, he received a regular commission in the USAF and served his first tour at Francis E. Warren AFB, Wyoming. Captain McLain performed duties as an Operational Contracting Officer for four years until he entered AFIT in 1990.

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12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

The purpose of this study was to develop and test a hypertext version of the Certified Professional Contracts Manager Candidate's Workbook and Supplements. A literature review was conducted on two distinct subject areas. The first area includes a review of the findings of six commissions on professionalism of acquisition personnel, initiatives of the Office of Personnel Management, the Defense Acquisition Workforce Improvement Act, and the National Contract Management Association. The discussion of professionalism in contracting establishes the relevance of products like the hypertext workbook completed as a result of this research. The second area is a review of the history of hypertext, applicable definitions, application schemes, and system design. Through a development effort that followed five objectives, a complete hypertext workbook was designed and tested. The results of the questionnaire answered by ten graduate students revealed that the hypertext workbook was easy to install, learn and use.

14. SUBJECT TERMS
automation, computer applications, hypertext

15. NUMBER OF PAGES
83

16. PRICE CODE

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